

Thunderstorms with high rainfall intensities and damaging winds are common during the spring and summer months. Heavy fog, reducing prevailing visibility to ¼-mile (0.4 km) or less, occurs an average of 18 days a year. The prevailing wind direction is to the south with an average velocity of less than 10 miles (16 km) per hour (MWH 2002). The total annual precipitation is approximately 42 to 44 inches (in.) [107 to 112 centimeters (cm)], with nearly 50% occurring during the growing season from May to October. Precipitation is greater than or equal to 0.5 in. (1.3 cm) approximately 28 days per year. Table 2-2 presents climatological data for southern Indiana.

There are four weather stations located in Jefferson County, three of which are active (COOP ID 122184 and 125237 and WBAN 53814). These stations collect limited data (e.g., minimum/maximum temperature, precipitation, etc.) that may be accessed from the National Climatic Data Center (NCDC) [see <http://www.ncdc.noaa.gov/>]. Information on wind speed and direction at all heights is not available in this region. The closest location where related data are collected is Wilmington, Ohio [National Weather Service (NWS) 2002]. Wind speed and direction data may be obtained from Indianapolis, Indiana, and Louisville, Kentucky. Data for the 30-year period ending in 1990 from the Louisville International Airport are provided in Table 2-3 (NWS 2002). These values are consistent with those reported in MWH (2002).

Air monitoring stations are located at six locations in Jefferson County (Wilson Road, Bacon Ridge Road, K Road, Graham Road, Kent Hall-State Hospital, and Sunrise Golf course), which at various points in time were used to monitor for total suspended particulates, sulfur dioxide, nitrogen dioxide, and/or nitrous oxides. The Wilson Road station was the only active station in 2001, which monitored sulfur dioxide. This information is based on EPA's air pollution database, AIRS.

The JPG region also is subject to tornadoes, which are most common in southeastern Indiana from May through July. A tornado occurred at JPG in 1998. The tornado path traversed the area north of the firing line, entering the installation north of F Road and exiting the installation at approximately H Road (see Figure 1-1). If the tornado followed a straight path, it would have touched down approximately 2.5 miles (4 km) north of the DU Impact Area. According to the NCDC, for the period from 1950 to 1995, an annual average of 20 tornadoes per year occurred in the State of Indiana. The annual average number of strong-violent tornadoes (F2-F5 on the Fujita scale) in Indiana is 7 (NCDC 2001).

The State of Indiana's ambient air quality standards are identical to the National Ambient Air Quality Standards. Air quality monitoring is conducted under the IDEM's Office of Air Management. JPG is located in a region that complies with both State of Indiana and Federal ambient air quality standards (IDEM 2001). During operation, JPG was not classified as a major source contributor to air pollution (U.S. Army 1995b). No emission sources are associated with the DU Impact Area.

2.5 GEOLOGY, SOILS, AND SEISMOLOGY

Information on JPG's bedrock and glacial geology, soils, and seismology are provided in Sections 2.5.1, 2.5.2, and 2.5.3, respectively.

2.5.1 Bedrock and Glacial Geology

JPG is located on the western flank of the Cincinnati Arch, a broad structural feature that separates the Illinois and Appalachian Basins (Figure 2-3). Most of the installation is covered by a layer of Pleistocene glacial deposits that overlies Paleozoic bedrock. These deposits average about 25 ft (7.6 m) in thickness, and range in thickness from 3.5 to 45 ft (1.1 to 13.7 m) [Figure 2-4]. The underlying bedrock consists of interbedded limestone, dolomite, and shale. The bedrock thickness encountered in wells drilled south of

Table 2-2. Climatology of Jefferson Proving Ground

Month	Temperature ^b					Precipitation ^c				
	Average ^a (°F)	Average Maximum ^a (°F)	Average Minimum ^a (°F)	2 Years in 10 Will Have		Average ^a (Inches)	2 Years in 10 Will Have		Average # of Days with 0.10 Inch or More ^a	Average Snowfall ^a (Inches)
				Maximum Higher Than ^a (°F)	Minimum Lower Than ^a (°F)		Less Than ^a (Inches)	More Than ^a (Inches)		
Jan	33.0	42.0	24.0	67	-3	3.21	1.8	4.36	7.36	5.4
Feb	36.7	46.7	26.7	69	1	3.34	1.52	4.82	7	2.3
Mar	44.5	55.4	33.7	80	14	4.48	2.48	6.1	9	2.9
Apr	55.8	68.4	43.5	86	25	4.03	2.02	5.66	9	0.1
May	65.2	77.5	52.8	93	33	4.48	2.59	6.01	8	0
Jun	73.8	85.3	62.2	97	45	4.01	2.36	5.46	7	0
Jul	77.0	88.1	65.9	98	51	3.76	2.18	5.03	7	0
Aug	75.8	87.3	64.2	98	50	2.61	1.18	3.78	5	0
Sep	70.1	82.3	57.9	97	40	3.15	1.49	4.49	6	0
Oct	59.0	71.4	46.5	88	27	2.6	1.27	3.68	5	0
Nov	46.4	56.3	36.5	79	14	3.25	1.78	4.44	6	0.6
Dec	35.7	44.7	26.8	70	2	3.05	1.54	4.29	6	1.8
Average	56.1	67.1	45.1	—	—	—	—	—	6.8	1.09
Extreme	—	—	—	102	-5	—	—	—	—	—
Total	—	—	—	—	—	41.97	35.46	48.16	82	13.1

^aSource: MWH 2002 (data recorded in the period 1951–1976 at Madison, Indiana).

^bTo convert from Fahrenheit to Celsius, subtract 32 and multiply by 5/9.

^cTo convert from inches to centimeters, multiply by 2.54.

Table 2-3. Average Monthly Wind Speed and Direction from 1960–1990, Louisville International Airport

Month	Wind Speed (miles per hour) ^a	Direction (Degrees)
January	9.6	290
February	9.6	300
March	10.1	310
April	9.8	180
May	8.0	180
June	7.4	180
July	6.9	180
August	6.4	180
September	6.8	180
October	7.2	180
November	9.0	180
December	9.1	180
Average	8.3	180

Source: NWS 2002.

^aTo convert from miles/hour to km/hour, multiply by 1.61.

the firing line has varied from approximately 10 to 65 ft (3 to 20 m) [MWH 2002]. The thickness of the underlying bedrock formations is variable, as shown on the cross-section of the cantonment area in Figure 2-5, reflecting the installation's location on the Cincinnati Arch. For example, the Louisville Limestone has a thickness of approximately 50 ft (15.2 m) on the western edge of the installation but pinches out to the east (Figure 2-5) [MWH 2002].

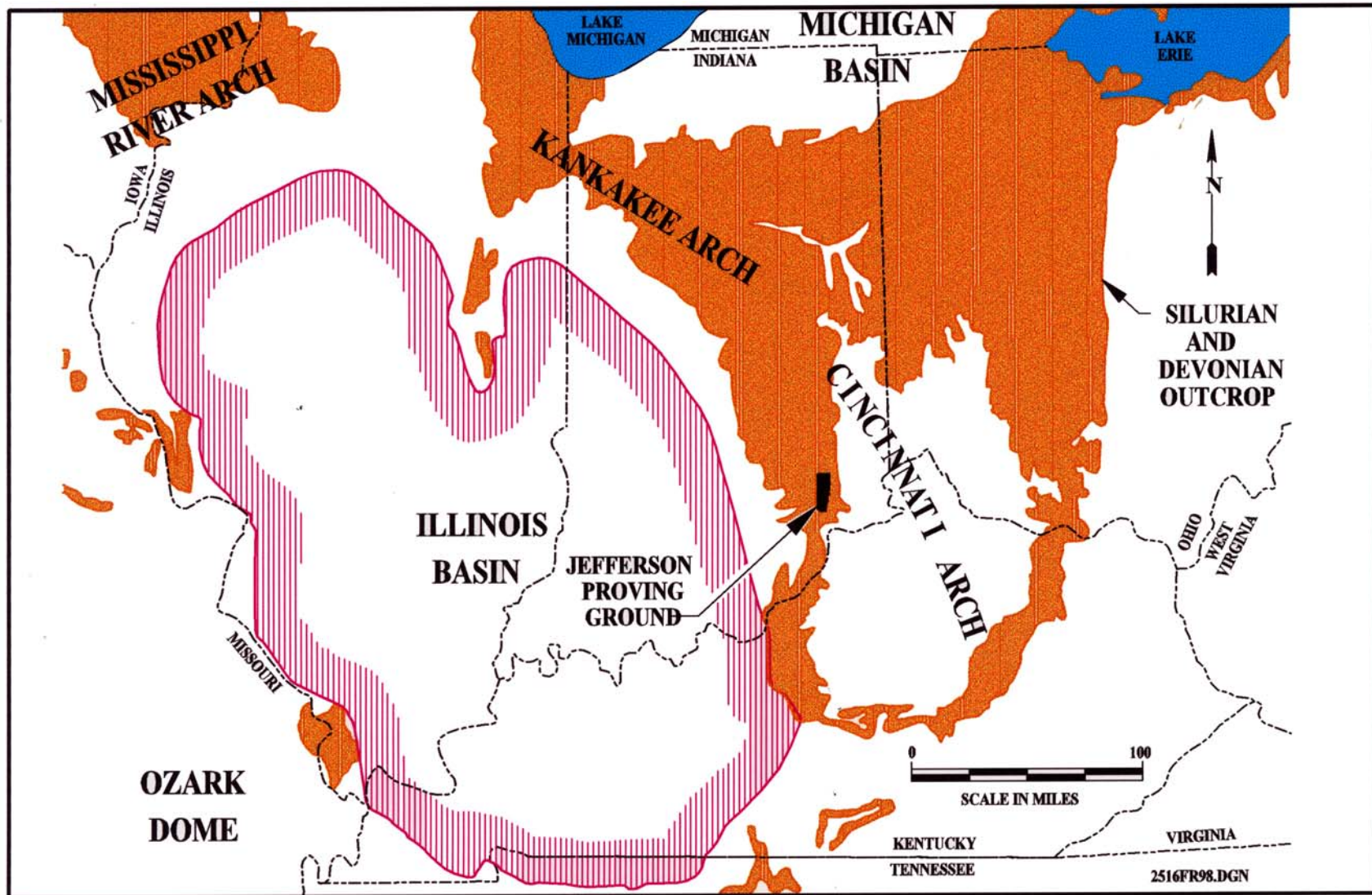
Within the DU Impact Area, the depth to bedrock ranges from 2 to more than 19 ft (0.6 to more than 5.8 m) based on the stratigraphy in the groundwater monitoring wells in this area. The bedrock in this area is described as fine-grained, light-to-medium gray limestone with shale streaks.

The overlying glacial deposits south of the firing line consist of interbedded silts and clays, and silts with gravel, based on a review of borehole logs from wells drilled on the installation. Closer to the bedrock contact, the glacial deposits contain chert, dolomite, and limestone rock fragments overlain by silt and clay layers that contain discontinuous gravel lenses (MWH 2002).

Within the DU Impact Area, the glacial deposits are described as brown, silty clay containing some black gravel/rock fragments and some chalky white rock fragments. From the ground surface to a depth of 1 to 1.5 ft (0.3 to 0.5 m) below ground surface (BGS) has been disturbed from detonation.

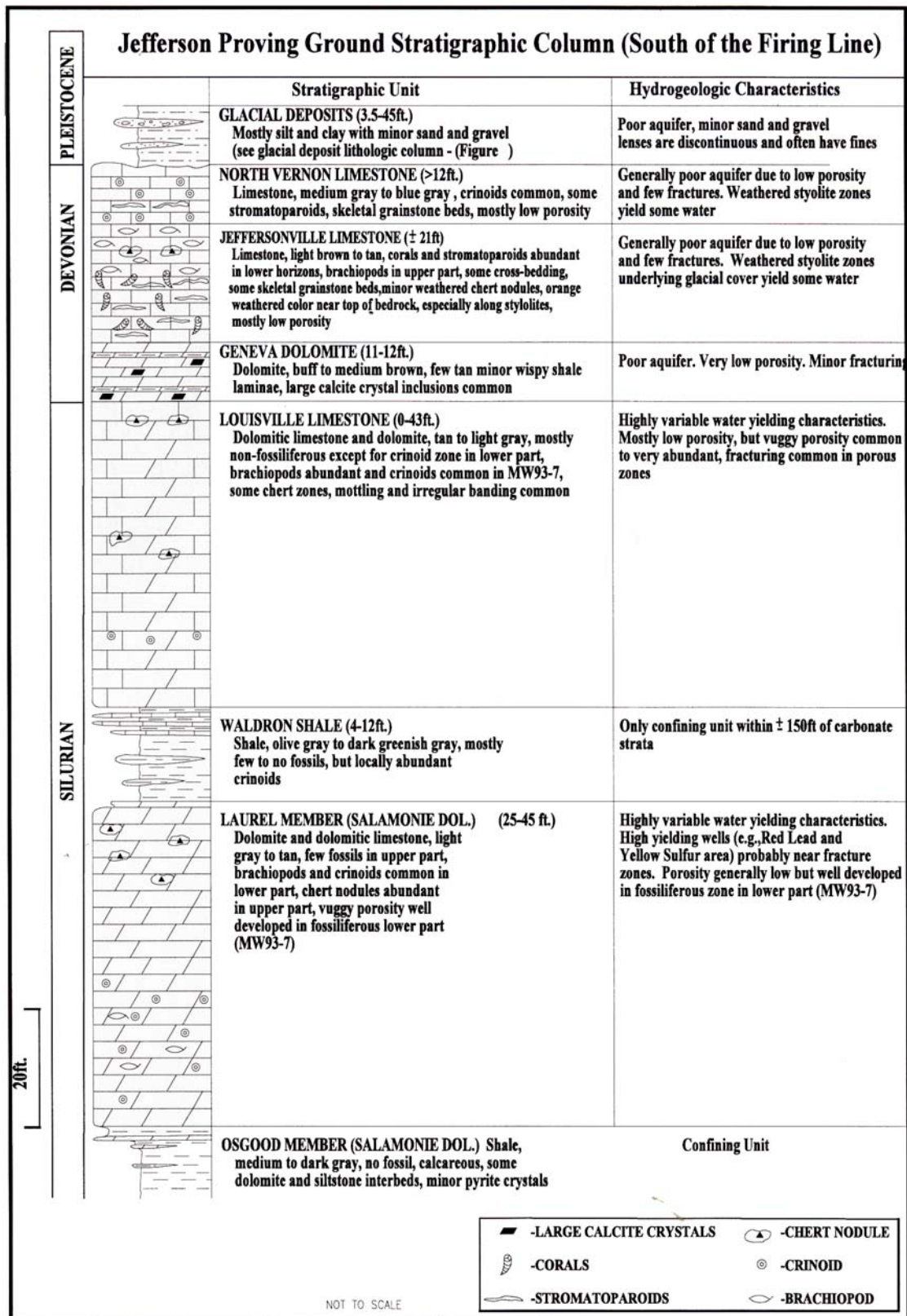
2.5.2 Soils

Soils at JPG developed from glacially derived parent material. There are two major soil associations present on the installation: Cobbsfork-Avonburg and Cincinnati-Rossmoyne Hickory (Figure 2-6). The Cobbsfork-Avonburg soils are present on upland glacial drift plains characterized by smooth topography with slopes ranging from 0 to 4%. The nearly level Cobbsfork soils have a seasonal high water table and are located on tabular divides. Typically, these soils have surface and subsurface layers composed of grayish-brown silt loam; both layers are about 6 in. (0.15 m) thick. The Avonburg soils also have a seasonal high water table and are located in relatively broad tabular divides and upper back slopes. These soils have a low-permeability fragipan in the subsoil. These soils have a brown silt loam surface layer about 10 in. (0.25 m) thick (MWH 2002).



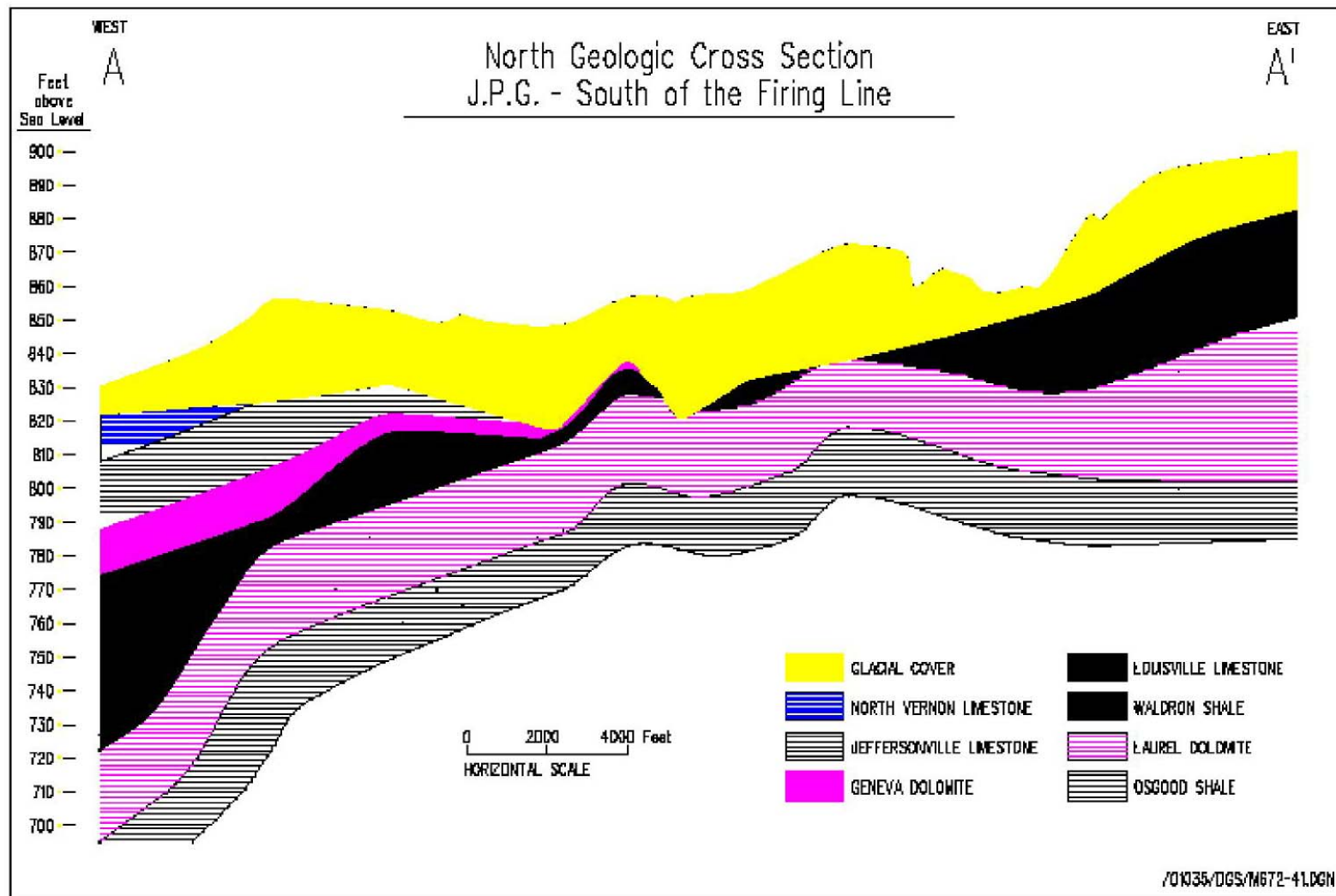
Source: MWH 2002.

Figure 2-3. Regional Structural Setting of Jefferson Proving Ground



Source: MWH 2002.

Figure 2-4. Stratigraphic Column for Jefferson Proving Ground



Source: MWH 2002.

Figure 2-5. West-East Cross-Section Across the Cantonment Area at Jefferson Proving Ground